

**CLAIMS**

1    **What is Claimed is:**

2    1.    An apparatus for determining whether noise problems potentially will occur on  
3    signal lines within an integrated circuit (IC), the signal lines being conductive metal  
4    lines in the IC, the apparatus comprising:  
5                first logic, the first logic comparing a signal transition time with a maximum  
6    signal transition time constraint for a particular conductive metal line of the IC; and  
7                second logic, the second logic determining whether said signal transition time  
8    exceeds said maximum signal transition time, wherein if a determination is made by  
9    the second logic that said signal transition time exceeds said maximum signal  
10   transition time, a potential noise problem exists with respect to said particular  
11   conductive metal line.

1 2. An apparatus for determining whether noise problems potentially will occur on  
2 signal lines within an integrated circuit (IC), the signal lines being conductive metal  
3 lines in the IC, the apparatus comprising:

4 first logic, the first logic determining the maximum length line that can be  
5 driven by each driver of the IC and the respective maximum transition time associated  
6 with the respective drivers and the respective maximum length lines associated with  
7 the respective drivers;

8 second logic, the second logic determining a transition time for each signal on  
9 the IC being driven by respective drivers over respective conductive metal lines of the  
10 IC; and

11 third logic, the third logic determining whether said transition time for each  
12 signal exceeds the maximum transition time associated with the driver driving the  
13 respective signal over the respective conductive metal line in the IC, wherein if a  
14 determination is made that a transition time of a signal exceeds the maximum  
15 transition time associated with driver driving the signal, then a determination is made  
16 that a potential noise problem exists with respect to the conductive metal line over  
17 which the signal having the transition time exceeding the maximum transition time is  
18 driven.

1 3. The apparatus of claim 2, wherein the first, second and third logic correspond  
2 to a computer executing a software program that makes the determination of whether  
3 a noise problem will potentially occur on a signal line.

1 4. The apparatus of claim 2, wherein the apparatus is a design tool used during  
2 the design of the IC prior to manufacturing the IC.

1 5. The apparatus of claim 2, wherein the first, second and third logic correspond  
2 to separate software routines being executed by a computer, the software routine  
3 associated with the first logic being a separate program from the software routines  
4 associated with the second and third logic.

1 6. The apparatus of claim 3, wherein the determinations made by the first and  
2 second logic are saved in a memory element accessible by the computer and  
3 associated with each other so that stored determinations can be utilized repeatedly by  
4 the computer to make the determinations associated with the third logic repeatedly for  
5 different IC designs.

1 7. The apparatus of claim 2, wherein the determinations performed by the first,  
2 second and third logic are independent of an IC processing technology used to design  
3 the IC.

1 8. The apparatus of claim 2, wherein a processing technology used to design the  
2 IC is a metal oxide semiconductor field effect transistor (MOSFET) technology.

1 9. The apparatus of claim 1, wherein a processing technology used to design the  
2 IC is a complementary metal oxide semiconductor (CMOS) field effect transistor  
3 (FET) technology.

1 10. An apparatus for determining whether noise problems potentially will occur on  
2 signal lines within an integrated circuit (IC), the signal lines being conductive metal  
3 lines in the IC, the apparatus comprising:  
4       a memory element, for drivers of different sizes, the memory element having  
5 maximum transition time constraints stored therein;  
6       a processor in communication with the memory element, wherein for a design  
7 of the IC, the processor determines a transition time for each expected signal of the IC  
8 design that is to be driven by respective drivers over respective conductive metal lines  
9 of the IC, and then determines whether the transition time for each signal exceeds the  
10 maximum transition time constraint associated with the driver driving the respective  
11 signal over the respective conductive metal line in the IC design, wherein if a  
12 determination is made by the processor that a transition time of a signal exceeds the  
13 maximum transition time associated with driver driving the signal, a determination is  
14 made by the processor that a potential noise problem exists with respect to the  
15 conductive metal line over which the signal having the transition time exceeding the  
16 maximum transition time is driven.

1 11. A method for determining whether noise problems potentially will occur on  
2 signal lines within an integrated circuit (IC), the signal lines being conductive metal  
3 lines in the IC, the method comprising the steps of:  
4 determining the maximum length line that can be driven by each driver of the  
5 IC and the respective maximum transition time associated with the respective drivers  
6 and the respective maximum length lines associated with the respective drivers;  
7 determining a transition time for each signal on the IC being driven by  
8 respective drivers over respective conductive metal lines of the IC; and  
9 determining whether said transition time for each signal exceeds the maximum  
10 transition time associated with the driver driving the respective signal over the  
11 respective conductive metal line in the IC, wherein if a determination is made that a  
12 transition time of a signal exceeds the maximum transition time associated with driver  
13 driving the signal, then a determination is made that a potential noise problem exists  
14 with respect to the conductive metal line over which the signal having the transition  
15 time exceeding the maximum transition time is driven.

1 12. The method of claim 11, wherein the method is performed by a computer  
2 executing a software program that makes the determination of whether a noise  
3 problem will potentially occur on a signal line.

1 13. The method of claim 11, wherein the method is performed by a design tool  
2 used during the design of the IC prior to manufacturing the IC.

1 14. The method of claim 11, wherein each of the determining steps corresponds to  
2 a separate software routine being executed by a computer.

1 15. The method of claim 11, wherein a processing technology used to design the  
2 IC is a metal oxide semiconductor field effect transistor (MOSFET) technology and  
3 wherein said method is used during the design of the IC.

1 16. The method of claim 11, wherein a processing technology used to design the  
2 IC is a complementary metal oxide semiconductor (CMOS) field effect transistor  
3 (FET) technology and wherein said method is used during the design of the IC.

1 17. A method for determining whether noise problems potentially will occur on  
2 signal lines within an integrated circuit (IC), the signal lines being conductive metal  
3 lines in the IC, the method comprising the steps of:  
4 for drivers of different sizes, storing in a memory element associated  
5 maximum transition time constraints;  
6 for a design of the IC, utilizing a processor to compare a transition time for  
7 each expected signal of the IC design that is to be driven by respective drivers over  
8 respective conductive metal lines of the IC with an associated maximum time  
9 constraint read by the processor from the memory element, wherein if the result of the  
10 comparison is that a transition time of an expected signal exceeds the associated  
11 maximum time constraint read out of the memory element the processor determines  
12 that a potential noise problem exists with respect to the conductive metal line over  
13 which the signal having the transition time exceeding the maximum transition time is  
14 driven.

1 18. A method for determining whether noise problems potentially will occur on  
2 signal lines within an integrated circuit (IC), the signal lines being conductive metal  
3 lines in the IC, the method comprising the steps of:

4 comparing a signal transition time with a maximum signal transition time for a  
5 particular conductive metal line of the IC; and

6 determining whether said signal transition time exceeds said maximum signal  
7 transition time, wherein if a determination is made that said signal transition time  
8 exceeds said maximum signal transition time, a potential noise problem exists with  
9 respect to said particular conductive metal line.

1 19. A computer program for determining whether noise problems potentially will  
2 occur on signal lines within an integrated circuit (IC), the signal lines being  
3 conductive metal lines in the IC, the computer program being embodied on a  
4 computer readable medium, the computer program comprising:

5 a first code segment, the first code segment comparing a signal transition time  
6 with a maximum signal transition time for a particular conductive metal line of the IC;  
7 and

8 a second code segment, the second code segment determining whether said  
9 signal transition time exceeds said maximum signal transition time, wherein if a  
10 determination is made that said signal transition time exceeds said maximum signal  
11 transition time, a potential noise problem exists with respect to said particular  
12 conductive metal line.

1 20. A computer program for determining whether noise problems potentially will  
2 occur on signal lines within an integrated circuit (IC), the signal lines being  
3 conductive metal lines in the IC, the computer program being embodied on a  
4 computer readable medium, the computer program comprising:  
5       a first code segment, the first code segment determining the maximum length  
6 line that can be driven by each driver of the IC and the respective maximum transition  
7 time associated with the respective drivers and the respective maximum length lines;  
8       a second code segment, the second code segment determining a transition time  
9 for each signal on the IC being driven by respective drivers over respective conductive  
10 metal lines of the IC; and  
11       a third code segment, the third code segment determining whether said  
12 transition time for each signal exceeds the maximum transition time associated with  
13 the driver driving the respective signal over the respective conductive metal line in the  
14 IC, wherein if a determination is made that a transition time of a signal exceeds the  
15 maximum transition time associated with driver driving the signal, then a potential  
16 noise problem exists with respect to the conductive metal line over which the signal  
17 having the transition time exceeding the maximum transition time is driven.